PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

VOL. XXVIII JUNE, 1921 NUMBER 3

Prodryas persephone Scudder.

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PSYCHE is published bi-monthly, the issues appearing in February, April, June, August, October and December. Subscription price, per year, payable in advance: $2.00 to subscribers in the United States, Canada or Mexico; foreign postage, 15 cents extra. Single copies, 40 cents.

Cheques and remittances should be addressed to Treasurer, Cambridge Entomological Club, Bussey Institution, Forest Hills, Boston 30, Mass.

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Entered as second-class mail matter at the Post Office at Boston, Mass. Acceptance for mailing at special rate of postage provided in Section 1103, Act of October 3, 1917, authorized on June 29, 1918.

PSYCHE

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MUSCULATURE AND MECHANISM OF MOVEMENT OF THE TARSI IN APHIDS.[1]

By Leopoldo B. Uichanco,
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Los Baños, P. I.

The present work is an attempt to determine the muscles responsible for the movement of the tarsi in aphids. The manner of articulation of the first tarsal segment on the tibia and the mechanism of movement of the tarsi are discussed in some detail.

Material and Methods.

The form used was *Myzus persicæ* Sulzer. Like many other aphids, this species is a very favorable subject for anatomical study of the appendages on account of the semi-transparent condition of the integument, which renders the interior more or less visible, even in the living specimen. Two series were studied: (1) living material and (2) balsam preparations *in toto*. For the study of the living insects, both nymphs and adults, mounted in aqueous or saline media, were used. In these it was possible to follow the movements of the tarsi under both the 16-millimeter and the 4-millimeter objectives of an ordinary Bausch and Lomb microscope fitted with a No. 10 ocular. The muscle responsible for the movement and its tendons also showed a fairly sharp definition in the fresh, unstained preparations. Amputated legs were likewise studied, although not used as a basis for the investigation of tarsal movements for the reason that the operation might have brought about conditions which would tend to produce abnormal reflexes. A more careful preliminary anatomical study was made of fresh specimens with the aid of Schneider's acid carmine. This reagent was found to stain the nuclei of the hypodermal cells and the muscle bodies deeply, differentiating them fairly well from the

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[1] Contributions from the Entomological Laboratories of the Bussey Institution for Research in Applied Biology, Harvard University. No. 187.

A short tendon[5] connects it with the projection of the tarsus. The tendon which connects this muscle with the subproximal end of the tibia is relatively much longer and narrowly subfusiform, abruptly expanding subconically toward the point of origin.

It is of considerable interest in connection with the musculature of the tarsi in aphids that the flexor is absent, its function having been taken over by another arrangement which will be described presently. In the more primitive types of insects, as in the Blattidæ, two antagonistic sets of tarsal muscles are present. Miall and Denny (1886) found a flexor and a retractor moving the tarsi of *Blatta orientalis* Linn. The disappearance of the flexor tarsi in aphids must have been the result of degeneration consequent upon the more highly specialized habits of this insect.

The junction between the first and the second tarsal segments has not been satisfactorily studied in connection with the present work. It appears, however, that the two segments are more or less firmly connected by a narrow strip of articular membrane in such a way as to give the second tarsal segment only a very restricted amount of independent movement.

MECHANISM OF TARSAL MOVEMENT.

From an examination of the anatomical structure of the legs, as well as from direct study of their movements under the microscope, it is evident that movement in the tarsal region centers around the first tarsal segment. Apparently, the tension of the highly chitinized wall of the tibia has the tendency to stretch the articular membrane outward, and, since the single hinge is located at the ectal part of the articulation of the first tarsal segment with the tibia, where it offers resistance to the tension of the tibial wall, the tarsus is bent on this hinge at an angle of about 90 degrees. As the extensor tarsi contracts, an upward pull is applied on the entoproximal margin of the first tarsal segment. Pivoted on the

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[5] The term **tendon**, as used in the present paper, is applied to the more or less subcylindrical strand of tissue which connects the main body of the muscle with the inner wall of the insect's legs. As used by Woodworth (1908), the word apparently has a different significance. So far as I was able to make out from both his discussion and his figures, it is apparently meant by him to apply to the projection or elongation of the chitinous wall which serves as the muscular insertion.

hinge, the tarsus is stretched medially and becomes extended so as to bring it at an approximately straight line with the tibia. Relaxation of the extensor removes the force which pulls the first tarsal segment at the place indicated, and the tension of the wall of the tibia brings the former back to its original position. It appears, therefore, that the wall of the tibia performs the function of the lost antagonistic muscle of the tarsi in aphids. The movement of the tarsi in either direction is limited by the articular membrane.

As has already been noted, the movement of the second tarsal segment is apparently very restricted, probably to the extent of merely giving the tarsus a certain amount of resiliency when the insect is walking. It has not been observed in the present work to flex to any marked extent either ectally or entally with respect to the first tarsal segment.

SUMMARY.

In certain more primitive insects, two antagonistic muscles move the tarsus. In the aphids, one of these is lost through degeneration or atrophy, only the extensor remaining.

The function of the lost antagonistic muscle is taken over by the walls of the tibia, which, by its tension, has the tendency to flex the tarsus outward at an angle with the tibia.

The tarsus moves on a single hinge, located at the ectal portion of the articulation of the first tarsal segment with the tibia.

The articular membrane limits the movements of the tarsus in either direction.

The second tarsal segment is apparently very restricted in its movement, perhaps to the extent of only giving the tarsus a certain amount of resiliency when the insect is in motion.

LITERATURE CITED.

MIALL, L. C., AND DENNY, A. 1886. The Structure and Life History of the Cockroach (*Periplaneta orientalis*): 77. Fig. 37. London and Leeds.

WOODWORTH, C. W. 1908. The Leg Tendons of Insects. The American Naturalist, **42**: 452-456.

EXPLANATION OF PLATE IV.

DETAILS OF LEGS OF *Myzus persicæ* SULZER.

A. Femur.

B. Tibia.

C. First tarsal segment.

c. Second tarsal segment.

D. Ungues.

E. Extensor tarsi.

F. Hypodermis of tibia.

G. Hinge at articulation of first tarsal segment with tibia.

H. Subconical projection of entoproximal margin of first tarsal segment, serving as base for insertion of extensor tarsi.

I. Another projection of first tarsal segment, connecting with articular membrane.

J. Articular membrane connecting proximal margin of first tarsal segment with distal margin of tibia.

Figure 1. Lateral view of leg, showing relative positions of femur and more distal adjoining segments; muscle and hypodermis. × 85.

Figure 2. Articulation and adjoining portions of femur and tibia, showing origin of extensor tarsi. Lateral aspect. × 350.

Figure 3. Distal portion of tibia and adjoining segments, showing insertion of extensor tarsi; articulation of first and second tarsal segments; hinge of first tarsal segment; and articular membrane. Lateral aspect. × 350.

Figure 4. Ectolateral portion of leg adjoining articulation of first tarsal segment with tibia, showing hinge. Lateral aspect. × 675.

Figure 5. Entolateral portion of leg adjoining articulation of first tarsal segment with tibia, showing articular membrane and the subconical projections at entoproximal margin of the first tarsal segment. Lateral aspect. × 675.

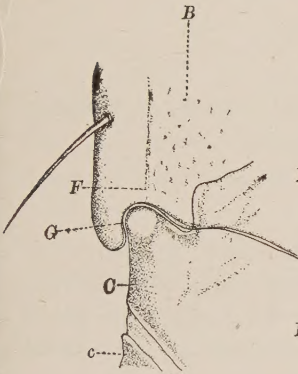

Fig. 4

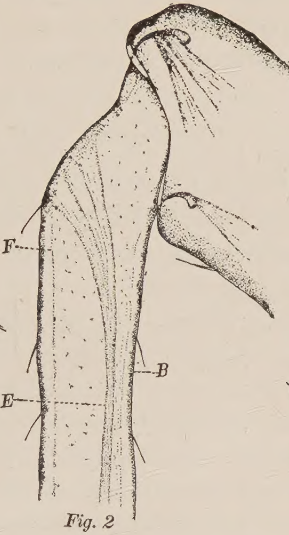

Fig. 2

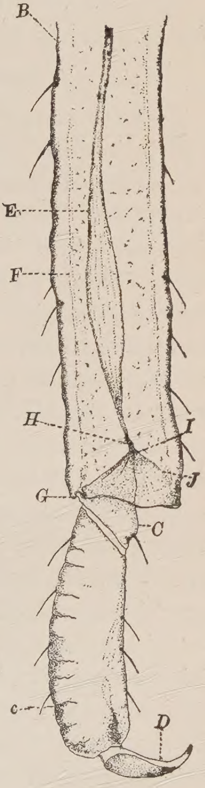

Fig. 3

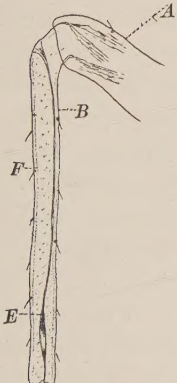

Fig. 1

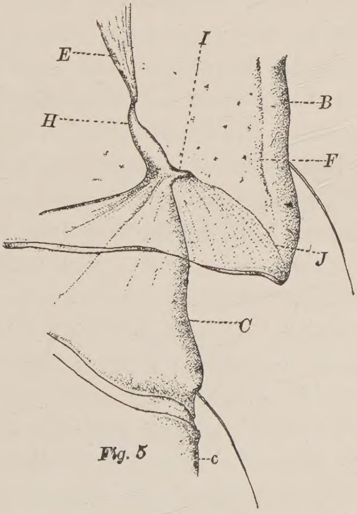

Fig. 5

UICHANCO—*Musculature of Tarsi in Aphids.*

DESCRIPTIONS OF NEW ICHNEUMONIDÆ IN THE COLLECTION OF THE MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASS.

By Henry L. Viereck,
Washington, D. C.

With one exception the following new species are all from localities in Virginia near the District of Columbia.

Ameloctonus xanthocerus sp. nov.

Type.—No. 11182, M. C. Z.

Type-locality.—Great Falls, Virginia, June 5 (N. Banks).

Female.—Length, 7 mm.; ovipositor 1.25 mm.; related to *A. clisiocampæ* Weed, from which it is readily known by the color of the antennæ, the less completely areolated propodeum, etc. Head black, dullish, finely densely sculptured, sericeous with silvery pubescence, temples and occiput between occipital carina and top of head shining and less densely sculptured than the face, facial line : transfacial line :: 25 : 34, axial line : temporal line :: 10 : 6, greatest diameter of lateral ocelli apparently a trifle longer than the ocellocular line, which latter is shorter than the lateral ocellar line which in turn is shorter than the postocellar line which in turn is distinctly shorter than the ocelloccipital line, clypeus truncate, finely granular and indistinctly punctured, mandibles mostly yellow, with brownish teeth, palpi mostly pale, antennæ mostly yellowish stramineous, blackish or black beyond the 10th joint, scape nearly as thick as long, pedicel apparently less than half as long as scape, joint 3 distinctly longer than 4 but shorter than 4+5 and at least three times as long as thick at apex, following joints subequal, joint 27 apparently thicker than long; thorax colored, sculptured and pubescent much like the head, mesonotum sculptured much like the clypeus except where the notauli ought to be where the sculpture is not so fine, pronotum reticulated, laterally striate, mesopleuræ mostly densely reticulated and punctured, the upper half with a striate depressed area and an almost sculptureless streak, scutel sculptured much like the clypeus, metanotum with indefinite sculpture, metapleuræ sculptured and pubescent much like the lower half of the mesopleura, wings almost colorless with a uniformly distributed brownish tinge, costa blackish, stigma yellowish stramineous, rest of veins brownish stramineous, bullæ whitish, cubitus beyond second transverse cubitus mostly paler than the other veins, areolet petiolate, receiving recurrent vein beyond its middle, the petiole shorter than the shortest side of areolet, wing base yellowish-stramineous, tegulæ mostly yellowish with a pale-stramineous margin, fore and mid coxæ and trochanters pale-stramineous, hind coxæ brownish stramineous, hind trochanters pale-stramineous, rest of fore and mid legs mostly brownish-stramineous except claws and empodia which are more or less brownish to blackish, hind femora reddish-brown, hind tibiæ and tarsi brownish-stramineous with the former darker near the base and at apex than elsewhere, hind claws and empodia concolorous with those of fore and midlegs, claws pectinate; propodeum black, finely sculptured and pubescent with silvery pubescence, exareolate beyond the basal transverse carina, the latter obtusely angulate in the middle, basalarea triangular, apical transverse carina incomplete, propodeum apparently shorter from base to apex, than wide at base, rather rugulose beyond the basal transverse carina, not at all depressed down the middle; abdomen shining, covered with pale pubescence and rather fusiform, truncate at apex, first segment with its basal two-thirds subcylindrical, its apical third convex but broader than thick dorso-ventrally, black throughout, petiole with a fossa on each side, spiracles distinctly nearer to each other than to the apex, second and third sternites yellowish stramineous, second tergite black except for the apical third which is mostly reddish, rest of tergites reddish except the sixth which has a black stain on its basal half above, thyridia rather oval, brownish much nearer the base than to the spiracles and as near the lateral edge as to the base, spiracles of second tergite apparently nearer the base than the apex and not much more than their own width from the lateral edge, sheaths of ovipositor blackish and hardly longer than the apical truncature of abdomen.

Angitia æstivalis sp. nov.

Type.—No. 11183, M. C. Z.

Type-locality.—Falls Church, Virginia; July 4, Aug. 27 (N. Banks).

Other localities.—Glencarlyn, June 30, Great Falls, June 21, Virginia (N. Banks).

Female.—Length 9 mm.; ovipostor 1 mm.; compared with the original description of (*Amorphota*) *Angitia? lawrencei* (Viereck). This species differs as follows: Very like (*Amorphota*) *Angitia? augusta* (Viereck) in color. Head.—Face indistinctly punctured, clypeus more distinctly punctured, antennæ 36-jointed. Thorax.—Hind coxæ black, hind proximal trochanters mostly black, other trochanters yellowish-stramineous, claws brownish to blackish and pectinate, all of fore tarsi reddish brown,mid onychii blackish, hind tibiæ reddish brown except for a blackish apex and a yellowish base, mid tarsi brownish stramineous, hind tarsi mostly blackish brown, the joints yellowish at base. Propodeum.—Basal area circumscribed, nearly quadrate and nearly as large as the areolet, areola and petiolarea confluent, slightly concave, covered with decussating, conspicuous silvery hairs, costulæ wanting, lateral and median logitudinal carinæ present. Abdomen.—Compressed like a knife blade, black throughout, exserted portion of ovipostor apparently as long as the first tergite. Compared with the original description of *Angitia? augusta* (Viereck). This species differs in its wider cheeks, in its antennæ having more joints, stigma blackish brown. Areolet distinctly petiolate, fore and mid coxæ brownish stamineous, etc.

Campoplex banksi sp. nov.

Type.—No. 11184 M. C. Z.

Type-locality.—Falls Church, Virginia, July 12, at honey dew on tulip tree (N. Banks).

Female.—Length 10 mm.; ovipositor 1.5 mm.; black and sericeous with silvery pubescence; agrees with *C. nigricincta* (Ashmead) in the greatest diameter of lateral ocelli being longer than the ocellocular line, in the quadrate head with outside line of eyes and temples nearly in the same plane, etc., but differs in size, in the mandibles and palpi which are almost entirely black or blackish, in the antennæ which are black except for a brownish edge at apex of scape and pedicel, in the tegulæ which are stramineous, in the legs which are black or blackish except for the fore tibiæ and tarsi, basal half of mid tibiæ, part of mid tarsi, base of hind tibiæ and hind metatarsi, all of which are pale stramineous or yellowish white. in the propodeum which is rather indistinctly areolated, rugulose and longitudinally channeled, longitudinal carinæ virtually wanting, and the apical transverse carina confused with the sculpture down the middle of the propodeum, in the abdomen which has a yellowish band at apex of first and second tergites, the basal third of the second tergite mostly brownish, second sternite yellowish and brownish stramineous, and in the wings which are broadly margined with a blackish brown stain the lower edge of which is parallel or nearly parallel to the terminal or pale abscissa of the cubitus, stigma and costa blackish, rest of veins blackish-brown, areolet sessile, five-sided.

It gives me much pleasure to dedicate this beautiful species to its well-known collector.

Cryptohelcostizus Cushman.

Judging from the following species this is an atypical member of the Osprhynchotinæ with the spiracles of the first tergite in or before the middle and nearer to each other than to the apex of the tergite. According to Ashmead's classification this genus is related to *Callicryptus* Ashmead, it also has characters in common with *Spilocryptus* as exemplified by *S. extrematis* Cresson.

Cryptohelcostizus dichrous sp. nov.

Type.—No. 11189, M. C. Z.

Type-locality.—Southern Pines, North Carolina, November 3, 1908. (A. H. Manee).

Female.—Length 12 mm.; shiny, black except an almost continuous yellowish line along the eye margin of the head, the reddish abdomen and the deeply infumated wings; axial line : temporal line :: 25 : 10, malar space : width of mandiles at base as 8 : 8 or malar space or width of mandibles at base, each 336 u, anterior third of clypeus in the form of a broad facet, antennæ twenty-five jointed, the terminal joint truncate at apex, face with distinct punctures that are mostly either adjoining or one or two puncture width apart, non-facetted portion of clypeus punctured much like face, almost impunctate down the middle, shiny and finely sculptured, facetted portion polished or nearly so, pronotum mostly, deeply punctured, striate in and along the deepest portion of the sclerite, dorsulum punctured much like the face, but polished, its notauli deep and ribbed, mesopleuræ sculptured much like the dorsulum, sternauli wanting except for a difference in sculpture evidenced by short vertical striæ, metapleuræ rugoso-punctate, scutel planate or nearly so, rather truncate at apex, areolet pentangular, its inner side formed by the first transverse cubitus, distinctly longer than the next longest side that is formed by the second transverse cubitus, its upper side or second abscissa of radius a little shorter than the outer side, but a little longer than the lower inner side, the latter a little longer than the lower outer side which is the smallest side, nervulus received by the median cell before the basal vein, nervellus broken distinctly below the middle and forming an obtuse angle, fore tibiæ almost club-shaped, as if pinched near base; propodeum shiny, the upper aspect separated from the posterior aspect by the apical transverse carina, upper aspect polished, transversely striate down the middle, punctured laterally, its punctures adjoining or nearly, posterior aspect polished, coarsely reticulate except the upper half of the posterior aspect down the middle; abdomen punctured, its first tergite polished and with its punctures mostly from one to three puncture widths apart, the succeeding tergites a little more closely punctured, shiny and finely reticulated, fifth, sixth and seventh tergites with more or less shallow and indistinct punctures, ovipostor apparently a little more than 3.5 mm. long, its apex with a rather coarse structure.

Allotype.—No. 11189, M. C. Z. Southern Pines, North Carolina, Feb. 5, 1909 (A. H. Manee).

Compared with the description of the type given above this differs as follows: Length, 10 mm.; axial line : temporal line :: 19 : 8, malar space : width of mandibles at base :: 4 : 5, or malar space 168 u, width of mandibles at base 210 u, antennæ 26-jointed, the terminal joint not truncated, but nearly pointed, lower half of clypeus forming a broad, polished facet, the remainder of the clypeus dullish and sparsely indistinctly punctured; pronotum with faint striæ in the furrow, elsewhere more or less sparsely punctured, first transverse cubitus a little longer than the lower inner side of the areolet or the next longest side, second transverse cubitus a little shorter than the lower inner side, second abscissa of radius : lower outer side of areolet :: 5 : 4, fore tibiæ normal as in *Spilocryptus extrematis* Cress., posterior aspect of propodeum coarsely reticulate throughout; abdomen sculptured much as in the type but not so distinctly.

Holocremnus flaviclypeus sp. nov.

Type.—No. 11185, M. C. Z.

Type-locality.—Chain Bridge, Virginia, June 14 (N. Banks).

Male.—Length 8 mm.; compared with the original description of *H. virginiensis* Viereck this species differs as follows:—Head, black except the face below antennæ, which, including the clypeus is mostly yellow, lower edge of temples yellowish, transfacial line : facial line :: 36 : 33, interocellar space finely sculptured, though not so finely as along the ocellocular line, lateral ocellar line slightly shorter than the ocellocular line, clypeus apparently punctured and granular, scape almost entirely yellow, pedicel yellow beneath (antennæ broken), pedicel nearly one-half the length of scape; thorax, black except for appendages and yellowish tubercles, costa stramineous, stigma and other veins, except bullæ, brownish stramineous, stigma palest, terminal abscissa of cubitus mostly nearly as pale as center of stigma, fore coxæ yellow throughout as are the mid coxæ, hind coxæ black at base and laterally on basal half, elsewhere more or less reddish or yellowish, fore and mid femora yellowish, appendages of fore and mid onychii dark brown or blackish, basal half of their claws pectinate, hind trochanters concolorous yellowish, hind femora reddish, hind tibiæ brownish stramineous except for a yellowish base, hind tarsi yellowish, with darkened tips and darkened onychii, appendages of latter similar to those of fore and mid legs; propodeum, basal area triangular, petiolate, petiolarea transversely rugosostriate, areola mostly indefinitely sculptured; abdomen, distance between first pair of spiracles more than two-thirds the length of the post petiole, thyridia oval, spiracles of second tergite as near to the apex as to the base, abdomen mostly reddish above, post petiole partly reddish, second tergite with its basal half mostly black, its apex also black, third tergite blackish at base, remaining tergites reddish throughout, plica stramineous, rest of visible sternites reddish though not so dark as the tergites.

Holocremnus virginiensis sp. nov.

Type.—No. 11186, M. C. Z.

Type-locality.—Falls Church, Virginia, June 28 (N. Banks).

Other locality.—Glencarlyn, Virginia, June 24 (N. Banks).

Female.—Length 9.5 mm.; head dullish, covered with silvery pubescence, black and densely sculptured, temples and occiput shining and rather indistinctly punctured, transfacial line : facial line :: 41 : 34, lateral ocellar line distinctly shorter than the postocellar line, interocellar space coarsely reticulately sculptured, contrasting sharply with the fine reticulation along the ocellocular line, lateral ocellar line distinctly shorter than the ocellocular line and apparently as long as the greatest diameter of the lateral ocelli, postocellar line apparently half as long as the ocelloccipital line, eyes slightly concave along the inner margin, malar line distinctly shorter than the mandibles are wide at base but distinctly longer than half the width of the mandibles at base, axial line : temporal line :: 20 : 10, clypeus punctured and partly indistinctly striate, finely sculptured between the punctures, clypeus truncate, mandibles yellow with stramineous lower edge and blackish-castaneous teeth, antennæ black or blackish excepting the scape which is mostly yellowish in front, 37-jointed, scape apparently twice as long as thick, pedicel hardly one-third the length of the scape, joint 3 distinctly longer than 4 but shorter than 4+5 and at least 4 times as long as its greatest thickness, following joints subequal in length except the ultimate joint which is distinctly longer than the penultimate joint, latter joint apparently two and one-half times as long as thick; thorax, colored, sculptured and pubescent much like the head, mesonotum densely reticulated and punctured, in part almost striate-punctate, notauli represented by a more coarsely sculptured area than elsewhere on the anterior half of mesonotum, pronotum more or less striate all over, mesopleuræ and mesosternum mostly punctured and finely reticulated, the upper half of the former partly striate, partly sculptureless or nearly so, scutel sculptured much like the center of the mesonotum, metanotum coarsely indefinitely sculptured, wings transparent with a uniformly distributed brownish tinge, subcosta blackish, stigma and other veins dark brown excepting bullæ and most of the terminal abscissa of cubutus which latter is brownish-stramineous, areolet petiolate, recurrent vein received distinctly beyond the middle, wing base yellowish, tegulæ yellowish and pale stramineous, fore coxæ blackish brown at base, mostly yellowish, mid and hind coxæ blackish, concolorous, fore and mid trochanters and their tibiæ and tarsi mostly yellowish, fore and mid femora reddish stramineous except for yellowish tips, fore and mid onychiæ brownish, their claws pectinate and blackish, proximal trochanters of hind legs mostly blackish, their distal trochanters yellowish, their femora, tibiæ and tarsi reddish, their claws pectinate and blackish, metapleuræ sculptured like lower half of mesopleuræ; propodeum, mostly punctured and shining, basal area wider at base than at apex and distinctly longer than wide at base, not as distinctly separated from the areola as from the pleural areas, areola and petiolarea confluent and rugosopunctate, costulæ wanting, abdomen reddish, shining except the petiole which is mostly black and almost polished, plica brownish, petiole almost cylindrical, somewhat depressed above, with a fossa on each side, post petiole minutely reticulated and convex, distance between spiracles nearly two-thirds as great as the distance from spiracles to apex, second tergite finely reticulated and punctured, thyridia almost reniform, somewhat nearer to the lateral margin than to the base, spiracle with its diameter equal to the distance between it and the lateral edge of the second tergite, a little nearer to the base than to the apex, rest of abdomen more or less compressed, ovipositor a little longer than the apical truncature. In the paratype the areolet is neither petiolate nor sessile.

Idechthis nigriscapus sp. nov.

Type.—No. 11187, M. C. Z.

Type-locality.—Glencarlyn, Virginia, June 8, 17, 30, July 2, on flowers of *Ceanothus americana* (Nathan Banks).

Other localities.—Great Falls, June 25 and Sept. 24, and Falls Church, Va., June 11, 27 (N. Banks), Plummer Island, Maryland, Aug. 25, 1907 (A. K. Fisher).

Female.—Length 11 mm.; head dullish, covered with silvery pubescence, black and densely sculptured, temples and occiput shining and rather distinctly punctured, transfacial line : facial line :: 44 : 37, lateral ocellar line hardly more than half as long as the postocellar line and apparently a little shorter than the ocellocular line and as long as the greatest diameter of the lateral ocelli, postocellar line apparently a little longer than the ocelloccipital line, eyes slightly concave, along the inner margin, malar line more than half as long as the mandibles are wide at base, occiput extending distinctly behind a vertical plane tangent to the hind ocelli, axial line : temporal line :: 22 : 10, clypeus almost rugoso punctate, with adjoining punctures, truncate, mandibles yellow with brownish stramineous lower edge and castaneous teeth with blackish tips, palpi pale, antennæ black except for the apical edge of scape and pedicel which is stramineous, 44-jointed, scape nearly as thick as long, pedicel apparently less than half the length of the scape, joint 3 distinctly longer than 4 but shorter than 4+5 and at least three times as long as thick, following joints subequal in length except the ultimate joint which is distinctly longer than the penultimate joint, the latter joint apparently one and one-half times as long as thick, thorax colored, sculptured and pubescent much like the head, mesonotum densely reticulated and punctured, in part striato-punctate, notauli present on the anterior third and transversely striate, pronotum more or less striate all over, mesopleuræ and mesoternum mostly punctured and finely reticulated, the upper half of the former partly striate, partly sculptureless, scutel and metanotum more densely sculptured than mesonotum though apparently not more densely covered with pubescence, wings almost colorless, with a uniformly distributed brownish tinge, subcosta and stigma blackish, rest of veins dark brownish stramineous except bullæ which are whitish and the cubitus beyond the second transverse cubitus which is paler beyond its first ninth than its first ninth, areolet petiolate, the recurrent vein interstitial with the second transverse cubitus, wing base yellowish, tegulæ yellow and pale stramineous, fore coxæ mostly yellow brownish at base, mid coxæ with the basal half mostly black, the apical half mostly yellowish, hind coxæ black except for yellowish tips, all trochanters, fore and mid femora and most of fore and mid tibiæ more or less yellow or yellowish, fore tarsi except onychii, the latter and all of mid tarsi dark brown, hind femora reddish brown, hind tibiæ and tarsi blackish, their spurs stramineous, metapleuræ more closely and finely punctured than the mesopleuræ; propodeum, black, mostly shallowly punctured, shining and covered with silvery pubescence, basal apical and longitudinal carinæ present, the median longitudinal carinæ rather poorly developed, petiolareæ and third lateral area transversely ribbed, abdomen mostly reddish and shining, first segment black, petiole polished and cylindrical, post petiole minutely reticulated and bulbous, the distance from the spiracles to the apex nearly three times as great as the distance between the spiracles, second tergite black except for reddish brown apical margin and subtly sculptured, finely reticulated, thyridia oval, brownish, nearer to the lateral edge than to the middle of the tergite, spiracles of the second tergite distinctly beyond the middle and not as near to the lateral edge as are the thyridia, third tergite with its uper aspect, black and sculptured much like the second tergite, the sides of the third tergite, finely reticulated ,punctured, shining and reddish like the rest of the tergum except for a blackish longitudinal tinge down the middle of the compressed tergum, visible sternites, excepting the first, yellowish, abdomen obliquely truncate, ovipositor at least half as long as the abdomen. The recurrent vein is not always interstitial.

Labrorychus æstivalis sp. nov.

Type.—No. 11188, M. C. Z.

Type-locality.—Chain Bridge, Virginia, June 23 (N. Banks).

Other localities.—Falls Church, June 22, at flowers of *Ceanothus*, Glencarlyn, July 2, Virginia (N. Banks).

Type ♀; length 13 mm.; reddish maculated with black and yellow; head, transfacial line : facial line :: 42 : 35, axial line :

temporal line :: 26 : 12, narrowest space between eyes on front : narrowest space between eyes on face :: 23 : 14, occiput polished and punctured, black with a reddish border, vertex reddish with the interocellar region black, apparently as sparsely punctured and polished as the reddish edge of occiput except for the interocellar area where the punctures are deep and almost adjoining on each side of a median longitudinal fovea, front partly striate, partly nearly as closely punctured as the interocellar area and black except a border along the eye margin which is reddish and not so closely punctured as down the middle of the front, temples mostly reddish and punctured like the sides of the vertex, lower fourth mostly yellowish, malar space almost crowded out, finely sculptured, malar line apparently less than one-fourth the width of mandibles at base, face below antennal line, including clypeus and mandibles mostly yellow, face most densely punctured, clypeus polished, with a few scattered punctures, acutely pointed with its anterior edge stramineous, teeth of mandibles blackish, palpi yellow, antennæ mostly brownish, 10.5 mm. long, 51-jointed, scape almost as thick as long yellowish beneath, blackish above, pedicel mostly blackish nearly as long as scape, third antennal joint curved, blackish beneath and also on its basal half above, elsewhere brownish, joint 3 longer than 4+5 but shorter than 4+5+6, flagel with its apical half mostly blackish like the basal half above; thorax colored, sculptured and pubescent much like the head, prescutum mostly black, more densely punctured than the reddish scapulæ, notauli represented by punctures and rugosities, pronotum reddish with a black stain along the anterior margin, punctured and striate, upper half of mesopleuræ reddish, partly striate, mostly almost impunctate and polished, rest of mesopleuræ and all of mesosternum black and closely punctured, scutel rugoso-punctate, brownish stramineous and distinctly bounded anteriorly and laterally by a distinct carina, metanotum indefinitely sculptured, wings transparent, with a brownish tinge, subcosta and most veins blackish, stigma stramineous, transverse cubitus distinctly longer than the second abscissa of the cubitus, wing base yellowish, tegulæ brownish stramineous and concave, fore and mid coxæ mostly yellow, brownish stramineous at base, hind coxæ reddish except for a black spot on the inner aspect near the base, fore and mid trochanters yellow, hind trochanters mostly reddish with a blackish stain above, rest of legs mostly reddish or yellowish stramineous, empodia black, claws brownish stramineous, fore and mid tibiæ yellowish-stramineous above, reddish-stramineous beneath, fore tarsi yellowish, mid tarsi with the basal joint yellowish, the remaining joints brownish, hind tibiæ dark brown, hind tarsi pale brown, metapleuræ reticulated, black and reddish; propodeum reticulated, with a black band at base, elsewhere reddish, the neck of the propodeum extending nearly to the apex of the hind coxæ; abdomen mostly reddish and shining, first segment reddish throughout, almost cylindrical and polished, post-petiole planate above, the distance between the spiracles and the apex nearly twice the distance between the spiracles, second tergite blackish above, reddish laterally, subtly sculptured except at base and apex where it is nearly polished, spiracles of second tergite removed from the lateral margin at least as much as three times their diameter, the distance between the spiracles and apex nearly twice the distance between the spiracles, third tergite sculptured much like the second, a little more than half as long as the second tergite with somewhat more than the apical half blackish above, succeeding tergites successively shorter and blacker until the seventh which is hardly exserted, ovipositor distinctly longer than the apical truncature of the abdomen.

Zastenomorpha gen. nov.

According to the latest classification of the Ophioninæ* this genus appears to be related to *Nothanomalon* Szépligeti, from which it may be distinguished by the convex non-carinate scutel and in the second abdominal segment being shorter than the first. Propodeum extending to apex of hind coxæ.

Zastenomorpha lamina sp. nov.

Type.—No. 11190, M. C. Z.

Type-locality.—Great Falls, Virginia, June 16, Oct. 21 (N. Banks).

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*Szépligeti, Gen. Ins., fasc. 34, 1905.

Transfacial line or greatest width of head : facial line or greatest distance from top of head to apex of clypeus :: 42 : 32.

Female.—Length 12.5 mm.; head dullish black and densely sculptured, except on the temples and occiput, where it is rather indefinitely pitted and shining, head covered with silvery pubescence, lateral ocellar line shorter than the postocellar line and apparently as long as the ocellocular line and the greatest diameter of the lateral ocelli, eyes distinctly emarginate, malar line apparently not more than half as long as the mandibles are wide at base, ocelloccipital line apparently more than twice as long as the ocellocular line, occiput hardly extending behind a vertical plane tangent to the hind ocelli, axial line or greatest axial diameter of head : the temporal line or greatest diameter of temples :: 21 : 6, clypeus finely granular and punctured, truncate, mandibles black with blackish castaneous tips, palpi mostly pale, antennæ black, 41-jointed, scape nearly as thick as long, pedicel apparently less than half the length of the scape, joint 3 distinctly longer than 4 but shorter than 4+5 and nearly four times as long as thick at apex, following joints subequal in length, except the ultimate joint, which is distinctly longer than the penultimate joint, the latter joint almost exactly as thick as long; thorax, colored, sculptured and pubescent much like the head, mesonotum densely reticulated and punctured, notauli completely wanting, pronotum dorsally rather smooth, laterally striate, mesopleuræ with the upper half mostly almost sculptureless and polished partly punctured and striate, the lower half and the mesosternum granular and punctured much like the mesonotum, scutel and metanotum more densely sculptured than the mesonotum and densely covered with silvery pubescence, metapleuræ sculptured and pubescent much like the mesonotum, wings almost colorless with a brownish tinge that is intensified along the margin of the apical fourth, veins and stigma blackish except bullæ which are whitish and the cubitus beyond the second transverse cubitus which is mostly brownish stramineous, areolet petiolate receiving the recurrent vein beyond its middle, wing base pale stramineous, tegulæ black, coxæ, trochanters and femora mostly black, femora yellowish at apex, fore femora brownish stramineous above, fore and mid tibiæ and tarsi mostly whitish yellow, fourth, and fifth joints of fore tarsi and third, fourth and fifth joints of mid tarsi brownish to blackish, hind tibiæ black beneath, brownish above, yellowish at base, hind tarsi blackish except at base of hind metatarsi where they are yellowish, claws pectinate and with reddish brown tips; propodeum, black, rugulose, dullish and covered with silvery pubescence, nearly twice as long as broad at base, with a median, shallow, narrow, longitudinal furrow that is transversely striate, with a poorly circumscribed basal area and areola, the latter open at apex, apical transverse carina represented on each side by a short carina, abdomen shining, covered with pale pubescence and compressed like a thin knife blade, truncate at apex, first segment cylindrical with the apical third bulbous, black except the postpetiole which is reddish apically and laterally, spiracles distinctly nearer to each other than to the apex, venter beyond the first segment brownish stramineous, second tergite black except for the basal half which is brownish stramineous on the lateral fourths, thyridia stramineous, cuneiform, nearly one-sixth the length of the tergite, nearly adjoining the lateral edge of the tergite and the apical end of the basal half of the tergite, apical half of second tergite reddish along the lateral edge and with subapical reddish band, spiracles apparently nearer to the apical edge than to each other and almost adjoining the lateral edge, third tergite reddish except a longitudinal black streak above on the basal two-thirds, which streak broadens out toward the base of the tergite, the following tergites reddish except for a blackish tinge along the upper edge of the fifth and sixth tergites, sheaths of the ovipositor blackish and hardly longer than the apical truncature of the abdomen.

THE ORIGIN AND HOMOLOGIES OF THE SO-CALLED "SUPERLINGUÆ" OR "PARAGLOSSÆ" (PARAGNATHS) OF INSECTS AND RELATED ARTHROPODS.

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In several recent papers published in the Fiftieth Report of the Entomological Society of Ontario, the Transactions of the Entomological Society of London, and the Annals of the Entomological Society of America, I have called attention to many current misinterpretations of the homologies of various structures in insects; but since no figures were there given, in which the parts of insects were compared with those of Crustacea and allied arthropods, I would present the following brief consideration of the comparative anatomy of the paragnaths (or "superlinguæ") in insects, Crustacea, etc., as the second of a series of papers dealing with the comparative morphology of insects and their arthropodan relatives, from the standpoint of evolution (the first paper of the series, which deals with the evolution of the mandibles, has recently been published in the Journal of the New York Entomological Society).

During the course of these investigations, it has been a source of continual amazement to me that such patently impossible, and obviously untenable views concerning the interpretation of the mouthparts of insects, as are now current among entomologists, could have gained such universal acceptance in these days of scientific progress, when abundant, and easily-examined material, illustrating the true interpretation of the parts so clearly that the veriest tyro could not mistake them, is available to anyone with enterprise enough to capture a common mayfly naiad (nymph) from the nearest stony brook, and compare it with any common *Asellus* from the nearest pond! That this statement is not exaggerated may be seen, for example, when one compares the much-misunderstood "superlinguæ," "paraglossæ," or "maxillulæ" of an insect, such as the common mayfly naiad shown in Fig. 2 (Plate V), with the corresponding parts in one of the common *Ligyda exotica* (Fig. 1) from the Carolina coast. The ubiquitous *Asellus* *communis,* found in almost any pond, would have served equally well for the purpose of comparing the "superlinguæ" (paragnaths) in the two groups of arthropods, but *Ligyda* has a large median lobe, or lingua, which is not developed in *Asellus,* thus making it somewhat easier to compare all of the parts under consideration, in the two groups of arthropods (insects and Crustacea), and on this account, *Ligyda,* rather than *Asellus* is here used for the purpose of comparison.

If the underlip and maxillæ of the mayfly naiad are removed, as in Fig. 2, one may readily observe immediately behind, and between, the mandibles "md", a structure called the *hypopharynx,* which is composed of a median, tongue-like lobe, the *lingua,* "li", and a pair of lateral lobes, "pg", which the entomologists call "superlinguæ", or "paraglossæ" (a term which should be restricted to the outer lobes on either side of the glossæ of the labium). Similarly, in the crustacean shown in Fig. 1, if the underlip and the two pairs of maxillæ are removed, one may observe immediately behind, and between, the mandibles, "md", a hypopharynx (exactly like that of the mayfly shown in Fig. 2) composed of a median, tongue-like lingua, "li", and a pair of lateral lobes, "pg", which the carcinologists call *paragnaths.* In the following discussion, I have applied the carcinologists' term paragnaths, to the corresponding structures in insects, and I have applied the entomologists' terms lingua and hypopharynx to the corresponding structures in Crustacea, and allied arthropods.

The absolutely patent correspondence between the parts of the hypopharynx of an insect (Fig. 2), and a crustacean (Fig. 1), which is so simple and utterly obvious, that it should be evident to anyone possessed of even the rudiments of a knowledge of comparative anatomy, has apparently suffered through its very obviousness and simplicity, for the human mind is apt to regard the obvious with suspicion, as though it were a snare to entrap the careless or undiscriminating observer, and to seek for subtler analogies which appeal more strongly to the imagination, and stimulate the speculative faculties. The unmistakeable resemblance between the hypopharynx of an insect (Fig. 2) and that of a crustacean (Fig. 1), however, is not merely a superficial resemblance calculated to deceive the unwary, since the hypopharynx in the two groups not only occupies the same position, and has the same form and structure in both insects and Crustacea, but it also has exactly the same embryological development, and serves the same function (i. e., that of a secondary underlip, provided with taste organs, etc.) in both groups—and what more could one ask, to establish complete homology? I would therefore maintain that the so-called "superlinguæ" of insects do *not* represent the maxillulæ or first maxillæ of Crustacea, since they do not occupy exactly the same position, they do not exhibit the same form and structure, they do not have exactly the same embryological development, and they do not have exactly the same function in the two groups; and I would claim that the so-called "superlinguæ" of insects most emphatically do represent the paragnaths of Crustacea, since they agree with these in all of the features mentioned above.

Since the "superlinguæ" of insects represent the paragnaths of Crustacea, by comparing the higher Crustacea, which are near insects, with the lower Crustacea, which approach the trilobites and other primitive arthropods, we are able to trace the evolution of these structures, and to determine their morphological significance. In *Ligyda* (Fig. 1) the paragnaths, "pg", are rather closely associated with the median lingua, "li", which appears to be formed as a projection of the pharyngeal ridge, "pc", behind it, which apparently includes in its composition a portion of the sterna of certain of the mouthpart segments. In *Talorchestia* (Fig. 3) the lingua, "li", is represented by a double ridge, or lobe-like projection of the median pharyngeal ridge, "pc"; and it would appear that the median, basal portions of the paragnaths, "pg", likewise take part in the formation of the lingua, "li", so that the lingua of higher Crustacea and insects may be formed in part by the paragnaths, although the greater part of the lingua is probably formed by portions of the sterna of certain of the mouthpart segments, as is indicated by embryology. On either side of the median pharyngeal ridge, "pc", of Figs. 1 and 3, are rib-like structures, "tc", which are located at the base of the trophi or mouthparts. It is possible that the lingual loræ, "ll", of Figs. 2 and 8, represent modifications of these rib-like or ridge-like structures in insects, and it is also possible that certain of these structures may be the precursors of portions of the tentorium of insects, although I have not been able to determine this point as yet.

The pharyngeal ridge, "pc", of Fig. 3, etc., appears to represent a portion of the sterna of the mouthpart segments, which are quite broad in Fig. 4; and the lingua is not developed in the lower Crustacea. In *Mysis* (Fig. 4) the paragnaths, "pg", are borne at the anterior margin of the sternite, "mxs", of the first maxillary segment; and in the lower Crustacea, the paragnaths appear to be more closely associated with the maxillulæ or first maxillæ, than they are with the mandibles, thus indicating that the paragnaths may represent detached lobes of the first maxillæ.

In *Squilla* (Fig. 6), the paragnaths, "pg", are attached to the basal portions of the maxillulæ or first maxillæ, "mx", and in the very primitive crustacean *Apus* (Fig. 7) both paragnaths, "pg", and maxillulæ, "mx", arise from the same basal lamina, "bl", which projects internally beneath the body wall. The paragnaths and maxillulæ in Fig. 7 are bent over backward (instead of being represented in their normal upright position, as in Fig. 6), in order to show that both paragnaths and maxillulæ are borne on the same basal lamina. The fact that both paragnaths and maxillulæ arise from the same basal lamina in such primitive forms as *Apus,* would indicate that the paragnaths of higher Crustacea are merely detached lobes of the maxillulæ, possibly corresponding to the endites or gnathobase-like structures of the trunk limbs of *Apus;* and in the higher Crustacea, these paragnathal lobes become more or less separated from the remainder of the first maxillæ (maxillulæ), and become somewhat more closely associated with the mandibles, as a secondary modification.

I do not know of any instance in which the paragnaths are situated in front of the mandibles, so that the metastoma, "mts", of the trilobite *Triarthrus* (Fig. 10), which is situated in front of the bases of the so-called mandibular appendages, "md", (only the tips of the basal segments of these are shown in the figure) and occupies a position between the bases of the so-called second antennæ, "at", is situated too far forward in the head region, to occupy a position strictly comparable to that of the paragnaths, unless it be true that the so-called second antennæ of trilobites, are in reality the representatives of the mandibular appendages of other arthropods. In certain trilobites there is a rather deep median incision, or emargination in the metastoma, thus suggesting that this organ may have been formed by the union of two lobes like the paragnaths; but this cannot be demonstrated from the material at present available. The suggestion that the metastoma of trilobites may represent the united paragnathal lobes of Crustacea, is thus merely a speculation, and has no particular bearing upon the subject of the origin and development of the paragnaths in Crustacea and insects.

I imagine that there are still some individuals who will vigorously maintain that the "superlinguæ" of insects must represent the maxillulæ (first maxillæ) of Crustacea, on the ground that Folsom, 1900, has described in a collembolan embryo a supposed "superlingual" segment, or neuromere, which he claims is the representative of the first maxillary segment of Crustacea; and he further claims that since the "superlinguæ" are supposedly the appendages of this alleged "superlingual" segment, they must therefore represent the maxillulæ, or appendages of the corresponding first maxillary segment, in Crustacea.

In reply to this argument, it is sufficient merely to call attention to the fact that Philiptschenko, 1912 (Zeitschr. Wiss. Zoologie, Bd. CIII), who has made an exceptionally careful and thorough study of collembolan embryology, and has attempted to verify Folsom's work on these insects (Bull. Harvard Mus. Comp. Zoology, 1900, Vol. 36, No. 5), has demonstrated that the supposed "superlingual" neuromere, or embryonic segment, described by Folsom, exists only in its author's imagination; and recent writers who quote Folsom's mistaken observations as though they were established facts, are apparently wholly ignorant of Philiptschenko's work, and know even less of the anatomy and embryological development of the structures of Crustacea with which they seek to compare the structure of insects. If there were no other reasons for discrediting the statement that the "superlinguæ' represent the maxillulæ of Crustacea, the fact that the *paragnaths* (*not* the maxillulæ) of Crustacea develop embryologically in exactly the same position and in the same way as the "superlinguæ" do in the embryos of insects, would be sufficient to completely disprove this unfounded and misleading statement, and it is hardly in keeping with the modern scientific spirit to continue to promulgate such misinformation, when a little time spent in the reading of the literature of the subject, or in easily conducted research, would readily convince anyone of its falsity.

Carpenter, 1903 (Proc. Royal Irish Academy, Vol. 24, Section "B", Part 4), interprets the structures labeled "a", "b", and "c", in Fig. 9, of the paragnath of *Machilis maritima,* as the representatives of the lacinia, galea, and palpus of the first maxilla (or "maxillula") of a crustacean, in an effort to prove that the "superlinguæ" (paragnaths) of insects represent the maxillulæ of Crustacea. The structures which he figures in the "superlingua" of *Machilis,* however, are nothing like the true lacinia, galea, and palpus of the maxillulæ themselves, in Crustacea, but are exactly like similar structures found in the paragnaths of Crustacea, as one would expect to be the case if the "superlinguæ" of *Machilis* represent the paragnaths, not the maxillulæ, of Crustacea. Literally hundreds of Crustacea exhibit in their paragnaths small projections like those labeled "a" and "b" in Fig. 9; and these projections of the paragnaths of Crustacea not only have the same appearance as these structures in the "superlingua" of *Machilis,* but they also bear the same type of hairs, taste organs, etc., as in *Machilis.* Furthermore (as I have pointed out in several papers), the palpus of a maxilla of an insect, or crustacean, represents the terminal segments of a mouthpart limb (the endopodite) in which the basal segments form the body of the maxilla, the galea and lacinia being appendages (endites, or gnathobase-like structures) of the basal segments of the maxillary limb. Since the palpus represents the terminal segments of such a modified limb, and since the "superlinguæ" (paragnaths) do not represent modified limbs, they cannot possibly have a palpus; and the small outgrowth labeled "c" in Fig. 9 of the paragnath ("superlingua") of *Machilis,* is merely a small, secondarily formed appendage, similar in nature to the articulated appendage "c", borne on the paragnath of the crustacean shown in Fig. 5. In Fig. 14, Plate II, of a paper on *Anurida* (L.M. B. C. Memoir No. XIII), an appendage of this kind, borne near the tip of the paragnaths as in *Apseudes* (Fig. 5), is figured in the "maxillulæ" (i. e. the true paragnaths) of the insect *Anurida*, by Imms, 1906; and in both insects and Crustacea, these appendages of the paragnaths cannot possibly be homologized with the palpus, or terminal segments of the endopodite of the limb forming the maxillula, or first maxilla.

The principal points brought out in the foregoing discussion may be briefly summarized as follows. The great similarity between the hypopharynx of insects and Crustacea lends additional weight to the evidence of a very close relationship between these two groups of arthropods, furnished by a study of numerous other structures of the body as well; and since no such close correspondence in the details of the parts of insects and chilopods exists, it is infinitely more probable that insects were descended from crustacean-like (instead of chilopod-like) ancestors. The "superlinguæ" of insects are completely homologous with the paragnaths of Crustacea, because they occupy exactly the same position, and have the same form, structure, and function in the adult condition, and arise in the same location, and in the same fashion, during embryonic development *in both* groups of arthropods, thus fulfilling *all* the requirements for establishing complete homology between the corresponding parts in insects and Crustacea. Since the paragnaths of Crustacea are not the maxillulæ of Crustacea, it is folly to state that the "superlinguæ" of insects correspond to the maxillulæ of Crustacea, if they represent the paragnaths of Crustacea instead; and it is to be hoped that if anyone is unwilling or unable to inform himself as to the truth in this matter, that he will at least refrain from deceiving others by promulgating the misinformation that the "superlinguæ" of insects represent the maxillulæ of Crustacea, as though it were a demonstrated fact!

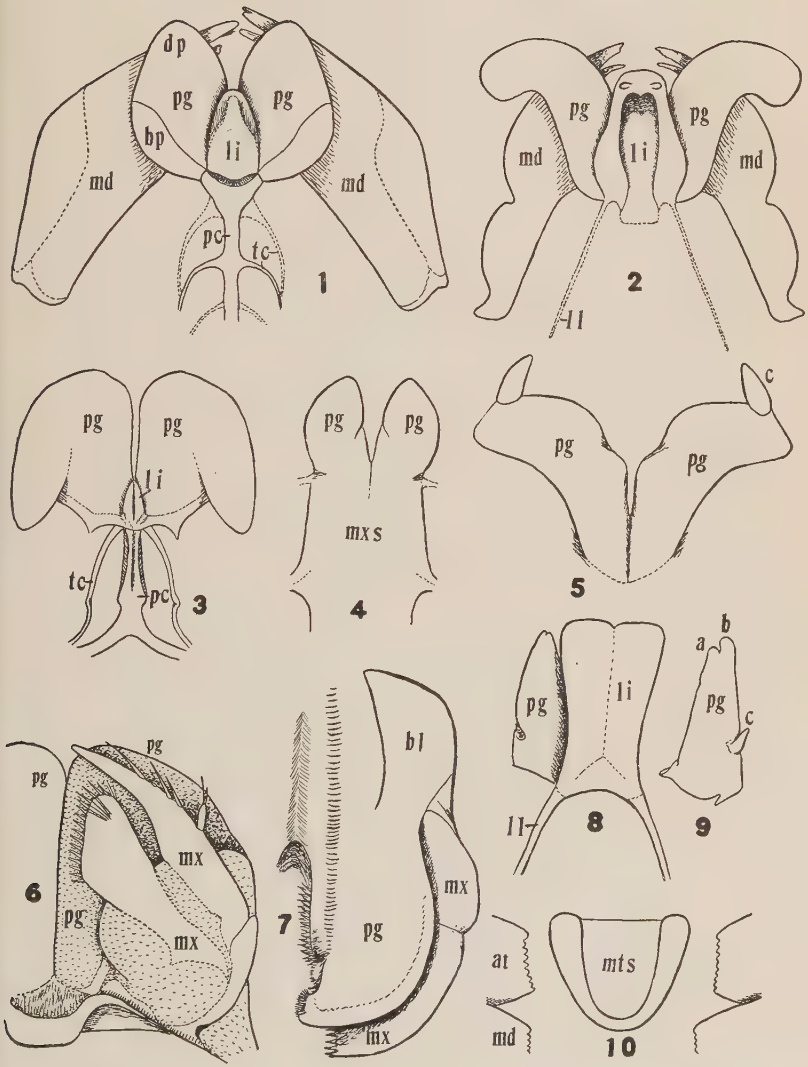
EXPLANATION OF PLATE V.

Fig. 1. Posterior (ventral) view of mandibles and hypopharynx of the crustacean **Ligyda.**

Fig. 2. Same of a nymph of the mayfly **Heptagenia.** The hypoporus, or salivary pore beneath the hypopharynx is not shown.

Fig. 3. Posterior (ventral) view of the hypopharynx of the crustacean **Talorchestia.**

Fig. 4. Ventral (posterior) view of the sternum of the first maxillary segment, and the paragnaths of the crustacean **Mysis.**



CRAMPTON—*Superlinguæ or Paraglossæ of Insects.*

Fig. 5. Posterior (ventral) view of the paragnaths of the crustacean **Apseudes.**

Fig. 6. Posterior (ventral) view of a paragnath and maxillula of the crustacean **Squilla.**

Fig. 7. Anterior (dorsal) view of a paragnath and maxillula of the crustacean **Apus,** bent over backward to show attachment to the basal lamina.

Fig. 8. Ventral (posterior) view of a paragnath and the lingua of the insect **Machilis.**

Fig. 9. Same view of a paragnath of **Machilis** taken from a drawing by Carpenter.

Fig. 10. Anterior view of metastoma of the trilobite **Triarthrus** from a drawing by Raymond.

Abbreviations.

a, Lobule of paragnath; **at,** Portion of basal segment of trilobitan limb homologized with second antenna; **b,** Lobule of paragnath; **bl,** basilamina, or basal lamina which bears the paragnath and maxillula; **bp,** Basiparagnath, or basal portion of paragnath; **c,** Epiparagnath, or appendage of paragnath; **dp,** Distiparagnath, or distal portion of paragnath; **li,** Lingua; **ll,** Lingualora, or lora of lingua; **md,** Mandibles; **mts,** Metastoma of trilobite; **mx,** First maxilla, or maxillula; **mxs,** Sternum of first maxillary segment; **pg,** Paragnaths, "superlinguæ", or "paragossæ"; **pc,** Pharyngocrista, or median pharyngeal ridge; **tc, Trophicostæ,** or rib-like structure at bases of trophi.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

At the meeting of February 8, Prof. W. M. Wheeler described the nesting habits of some ants of the genus *Carebara,* found in South America. These live in nests of Termites, making their own burrows between those of their hosts and feeding on the young of the latter. The various forms of these ants had been obtained from the stomachs of Anteaters killed near their nests. The males and females were of large size and the workers extremely small. When the males and females leave the nest for the mating flights some of these minute workers cling to their hairs, and when the females start new colonies these workers bring in food and feed the first-hatched young, which the female herself is unable to do.

Another genus of ants of small size, *Allomerus,* lives partly in the swoollen branches of certain plants, going up and down between the plant and the underground nest in earth-covered galleries attached to the hairs of the plant.

Prof. C. T. Brues described some guests of Ants and Termites from South America. Wingless flies of the family *Phoridæ* live in the nests of some ants and even travel with them in their raids outside the nest. In some termite nests are minute hymenopterous parasites with wings reduced to thread-like appendages. Specimens and enlarged drawings were shown.

Mr. C. W. Johnson spoke of the female of the rare fly *Glutops singularis,* and made some additions and corrections to his notice of this species in the December Psyche.

Mr. L. R. Reynolds and several other members discussed the recently published list of American Coleoptera by C. W. Leng.

At the meeting of March 8, Mr. L. R. Reynolds read a paper on zoological nomenclature, which was discussed by Messrs. Banks, Frost, Howe and Johnson. The discussion dealt mainly with the difficulties of the subject and led to no practical plans for improvement.

At the meeting of April 12, several designs for a club seal were shown.

Mr. Roland Hussey read a paper on "Hibernation of Aquatic Hemiptera." After a review of hibernation in general, Mr. Hussey told about his observations at a pond near Minneapolis, where he watched large numbers of Corixidæ which, as the cold weather came on, collected in the part of the pond where there was most vegetation, in some places on October 29, as closely as 150 to a square foot under two inches of ice. In January, under ice eight inches thick, there were but few in motion, and in February none, all being torpid at the bottom.

January 15, under ice two feet thick, a species of *Cymata* was found hibernating, entirely torpid, in air bubbles in the ice, without the insects themselves being frozen. Mr. Hussey started to investigate this curious method of hibernation, but was taken sick and obliged to give it up for the season, and the next winter conditions were unfavorable for continuing the study.

Mr. Gove showed a table which he had prepared of the elevations at which he had collected butterflies, showing that each species habitually flies at certain heights above the general level of the country.

Mr. C. A. Frost spoke of the recent collections of Coleoptera by Mrs. Hippisley, at Terrace, B. C., Canada, a newly settled country within a hundred miles of the Pacific Coast.

Mr. R. H. Howe, Jr., showed a metal tray of triangular section for holding insects wrapped in papers.

Mr. Howe spoke of the discoverey of insects in the peat at Eastham, Cape Cod.

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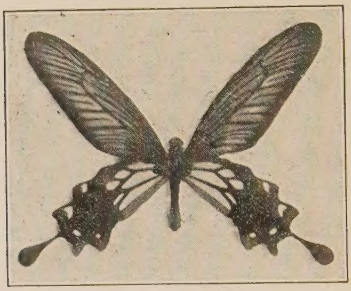

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